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FOREST STATISTICS FOR KITTITAS CO., WASHINGTON

FOREST SURVEY REPORT NO. 117

U. S. DEPARTMENT OF AGRICULTURE · FOREST SERVICE
PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
R. W. COWLIN, DIRECTOR

PORTLAND, OREGON OCTOBER 1954

PREPARED BY THE DIVISION OF FOREST ECONOMICS

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1/ Acknowledgment is made of cooperation from public and private agencies in furnishing cutting and ownership records.

FOREST STATISTICS

FOR

KITTITAS COUNTY, WASHINGTON

Forest Survey Report No. 117

by

F. L. Moravets

U. S. Department of Agriculture Forest Service
Pacific Northwest Forest and Range Experiment Station

R. W. Cowlin, Director
October 1954

FOREWORD

This publication summarizes in statistical form the results of a reinventory of the forests of Kittitas County, Washington, conducted in 1953. This reinventory is a part of the maintenance phase of the Forest Survey, a nationwide project of the Forest Service authorized by the McSweeney-McNary Forest Research Act of 1928 and amended June 25, 1949. The purpose of the Forest Survey is to periodically inventory the extent and condition of forest lands and the timber and other products on them, to ascertain rates of forest growth and depletion, to estimate present consumption of timber products and to analyze and make available in reports survey information needed in the formulation of forest policies and programs.

The Forest Survey is conducted in the various forest regions of the Nation by the regional forest experiment stations of the Forest Service. In the Pacific Northwest region of Oregon and Washington it is an activity of the Pacific Northwest Forest and Range Experiment Station at Portland, Oregon.

Under the initial phase of the Forest Survey the forests of Kittitas County were inventoried in 1935. A statistical report "Forest Statistics for Kittitas County, Washington" and a detailed forest type map--scale 1 inch to the mile--were released. The reinventory was conducted during the months of June to September 1953. Another result of the reinventory is a revised forest type map of the county, on a scale of either 1 or 2 inches to the mile. 1/

1/ A print of the forest type map is available at cost of blueprinting. For information write Director, Pacific Northwest Forest and Range Experiment Station, P. O. Box 4059, Portland 8, Oregon.

CONTENTS

	Page
Foreword	
Figure 1, Forest Stand-Size and Condition Classes, Kittitas County, Washington, 1953	
Significant Findings in the Forest Inventory	1
Land Classification	1
Timber Volume	2
Forest Ownership	3
Timber Utilization	4
Forest Survey Procedure	15
Initial Inventory	15
Reinventory	16
Accuracy of Reinventory Data	16
Forest Area	16
Timber Volume	17
Difference in Results of Inventories	17
Forest Area	17
Timber Volume	18
Definition of Terms Used	19
Land Area	19
Forest Land Classes	20
Forest Types	20
Tree Classes	21
Stand-Size Classes	21
Timber Volume	22
Timber Cut	23
Accuracy of Data	24

List of Tables

Table 1. Land area by major classes of land, 1953	5
Table 2. Area of commercial forest land by ownership and stand-size class, 1953	5
Table 3. Area of commercial forest land by major forest type and stand-size class, 1953	6
Table 4. Area of commercial and noncommercial forest land and nonforest land by cover type and ownership class, 1953	7

Page

Table 5. Area of commercial forest land by generalized forest type and ownership class, 1953 - - - - - - - - 8

Table 6. Net volume of live sawtimber and growing stock on commercial forest land by ownership class, 1953 - - 9

Table 7. Net volume of live sawtimber and growing stock on commercial forest land by stand-size class, 1953 - - 10

Table 8. Net volume of live sawtimber and growing stock on commercial forest land, by species, 1953 - - - - - - 11

Table 9. Net volume of live sawtimber on commercial forest land by diameter-class group, species group, and log rule, 1953 - 12

Table 10. Net volume of all timber on commercial forest land by class of material and species group, 1953 - - - 13

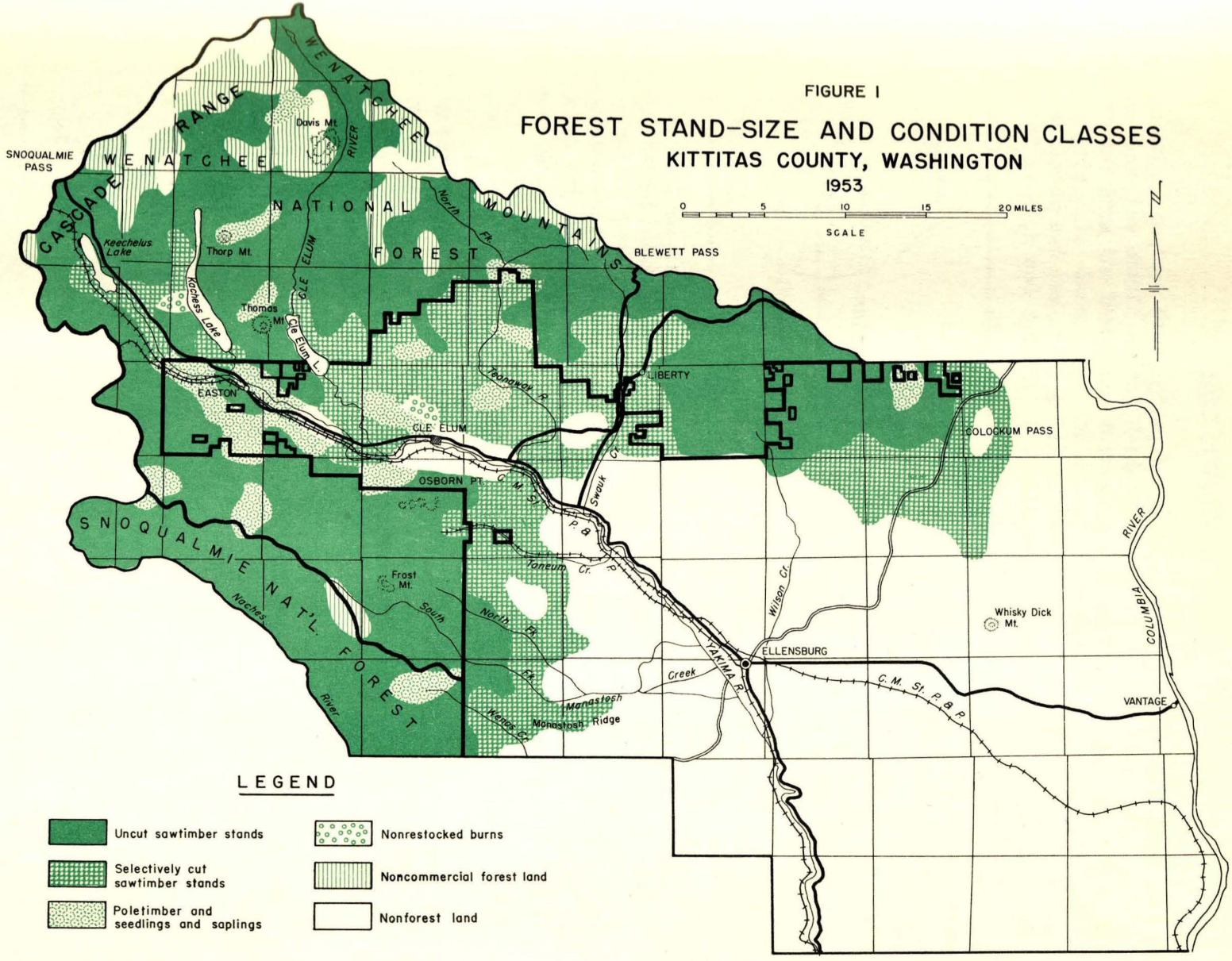
Table 11. Average annual timber cut from live sawtimber and growing stock on commercial forest land by species group for the period 1948-1952 incl. - - - - - - - - 14

FIGURE 1

FOREST STAND-SIZE AND CONDITION CLASSES

KITTITAS COUNTY, WASHINGTON

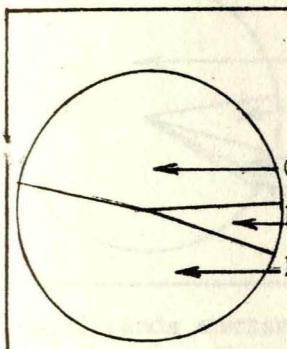
1953



SIGNIFICANT FINDINGS IN THE FOREST INVENTORY

LAND CLASSIFICATION

Situated in central Washington, Kittitas County reaches eastward some 70 miles from the summit of the Cascade Range to the Columbia River, and southward from the Wenatchee Mountains an average distance of about 35 miles (fig. 1). Except for the southeastern quarter, which consists of valley lands and low rolling hills, the county is mountainous terrain, some of it high and rugged. Elevations vary from about 550 feet along the Columbia River to nearly 8,000 feet on some of the high peaks of the Cascade Range. Much of the county lies between elevations of 3,000 to 4,500 feet. Annual precipitation on some of the mountainous western portion may be as high as 60 inches; in the eastern portion it may be as low as 7 inches. Approximately nine-tenths of the forest land area was classed as commercial forest land. About one-sixth of the nonforest land acreage is cropland, as classified by the Bureau of the Census in 1950, and the remaining five-sixths consists of grass and sagebrush-covered hills, mountain meadows and barrens, and town sites.

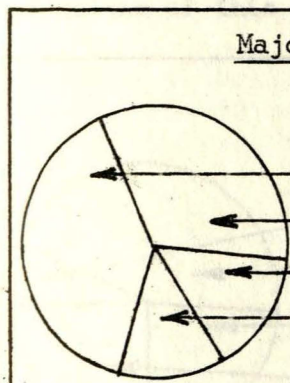


Land Use

Class	Thousand acres	Percent
Commercial forest	675	46
Noncom'l. forest	75	5
Nonforest	732	49
Total	1,482	100

Commercial Forest Land by Major Type

The mountainous terrain of the commercial forest zone results in a broken pattern of major forest types; no one type occurs over broad areas without intrusion from other types. Ponderosa pine, which favors the drier sites, is the key species in the stands covering the lower south- and east-facing slopes of the Yakima River and Naches River drainages. Douglas-fir predominates in stands on the slopes generally just above the ponderosa pine. The fir-spruce type on the upper slopes consists of a variety of mixed stands of true firs, mountain hemlock or Engelmann spruce. The key species in the "other" types is either western larch, western hemlock, lodgepole pine or western white pine.

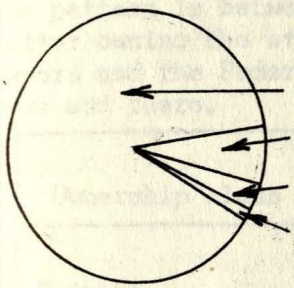


Major Forest Types

Type	Thousand acres	Percent
Ponderosa pine	268	40
Douglas-fir	227	33
Fir-spruce	94	14
Other	86	13
Total	675	100

Commercial Forest Land by Stand-Size or Condition Class

Timber utilization has influenced the character of the forests on about a third of the county's commercial forest acreage. To date a total of about 222 thousand acres has been logged, a large part of it by a selective type of logging. Of the 610 thousand acres classed as sawtimber, 190 thousand acres have been selectively logged; there has been no logging in the remaining 420 thousand acres of sawtimber. One-half of the poletimber acreage and two-fifths of the seedling and sapling acreage are on logged lands currently stocked with young timber less than sawtimber size. Slightly more than one-half of the nonstocked area is logged land.



Stand Size or Condition

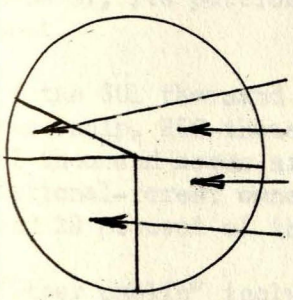
Class	Thousand acres	Percent
Sawtimber	610	90
Poletimber	44	6
Seed. and sap.	17	3
Nonstocked	4	1
Total	675	100

TIMBER VOLUME

Net volume of live sawtimber trees (11 inches d.b.h. and larger) on the commercial forest land is estimated to total 11,526 million board feet, log scale, Scribner rule. Of this total, 10,318 million is in uncut sawtimber stands, chiefly fir and other types, and 1,136 million in selectively cut sawtimber stands, primarily pine type. Scattered sawtimber trees in small young-growth stands and on nonstocked areas contain 72 million.

Volume of Sawtimber by Species

Until recent years ponderosa pine comprised three-fifths or more of the annual volume of timber cut in the county and the major portion of the original volume of this species has been logged. Almost half of the remaining pine volume is in reserve trees on selectively cut areas. Douglas-fir, the key species on a large acreage of sawtimber, is also a minor component in many of the stands predominantly of other species. Although much of the Douglas-fir is of rather low quality, some of it compares favorably with that found in western Washington. There are four species of true firs--Pacific silver, noble, white, and subalpine--in the county. "Other" species of appreciable volumes are western hemlock and western larch.

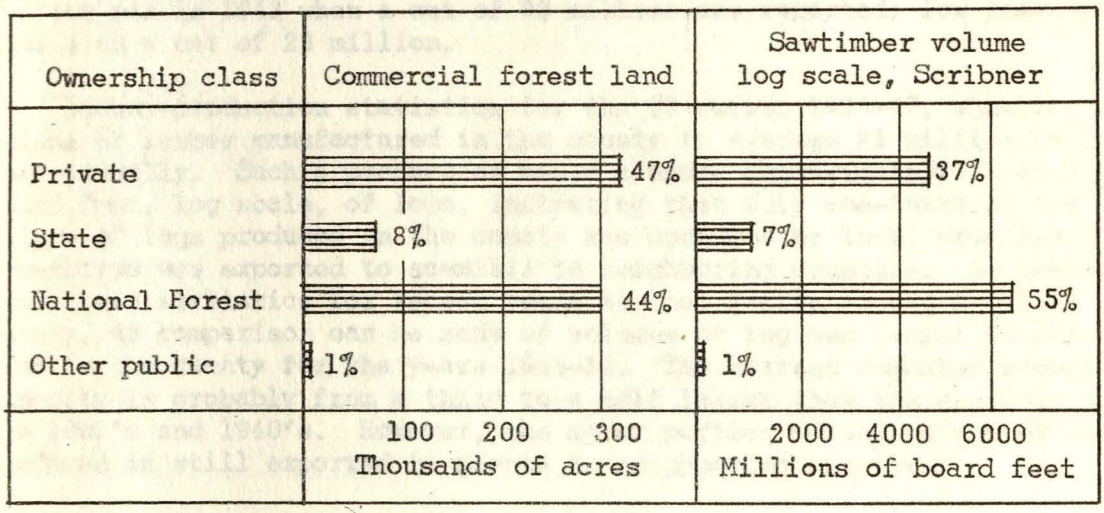


Sawtimber Volume

Species	Million bd. ft.	Percent
Ponderosa pine	825	7
Douglas-fir	5,067	44
True firs	2,605	23
Other	3,029	26
Total	11,526	100

FOREST OWNERSHIP

As a result of railroad land grants during the period of early western development a checkerboard pattern of ownership prevails throughout a very large part of the county's forest zone. Inside the two national forests, Wenatchee and Snoqualmie, the alternate pattern is between private--odd-numbered sections--and national forest--even numbered sections. In much of the forest zone outside national-forest boundaries the pattern is between private and the State of Washington, with the latter owning the even-numbered sections. Exchanges between private owners and the Federal and State governments have broken up the pattern here and there.



The 314 thousand acres of commercial forest land in private ownership includes 45 percent of the sawtimber acreage, 62 percent of the small young-growth acreage and 65 percent of the nonstocked area. The major portion of the private sawtimber acreage has been selectively logged, which accounts for the fact that the private portion of the estimated sawtimber volume, 37 percent, is smaller than the private portion of the total sawtimber acreage.

The State of Washington controls 8 percent each of the commercial forest land, the sawtimber acreage, and the young-growth acreage. However, its portion of the estimated sawtimber volume is only 7 percent.

Of the 301 thousand acres of commercial forest land in national-forest ownership, 250 thousand acres are in the Wenatchee National Forest and 51 thousand acres are in the Snoqualmie National Forest. The combined national-forest ownership includes 46 percent of the sawtimber acreage and 28 percent of the acreage of young-growth timber.

"Other public" includes small acreages and volumes administered by the Federal Bureaus of Land Management and of Reclamation, by the county, and by municipalities.

TIMBER UTILIZATION

During the 5-year period, 1948-52, the volume of live sawtimber cut annually on the county's commercial forest land has averaged 68 million board feet, log scale. Approximately 95 percent of this volume has been removed from the forest in the form of timber products, very largely logs, and 5 percent has been left on the ground as logging residue (table 11).

The volume of annual cut has been unusually stable, according to log-production statistics; during the 23 years prior to 1948 the cut averaged 60 million board feet, log scale, annually. Peak year of production was in 1943 when a cut of 83 million was reported; low year was 1938 with a cut of 29 million.

Lumber-production statistics for the 23 years, 1925-47, show the volume of lumber manufactured in the county to average 22 million board feet annually. Such a production would consume approximately 20 million board feet, log scale, of logs, indicating that only one-third of the volume of logs produced in the county was consumed by local sawmills; two-thirds was exported to sawmills in neighboring counties. As lumber-production statistics for recent years are not available for Kittitas County, no comparison can be made of volumes of log and lumber production in the county for the years 1949-53. The current combined sawmill capacity is probably from a third to a half larger than the capacity in the 1930's and 1940's. However, the major portion of the volume of logs produced is still exported to plants in neighboring counties.

Table 1.--Land area by major classes of land, 1953

Class of land	Area
	Acres
Forest:	
Commercial	674,680
Noncommercial:	
Productive-reserved	7,010
Unproductive	68,200
Total	749,890
Nonforest	731,710
Total, all classes	1,481,600

Table 2.--Area of commercial forest land by ownership and stand-size class, 1953

Ownership class	Total	Saw-timber stands	Pole-timber stands	Seedling and sapling stands	Nonstocked areas
	Acres	Acres	Acres	Acres	Acres
Private	313,900	273,510	27,110	10,910	2,370
State	55,240	49,870	3,450	1,720	200
County	520	380	140		
Municipal	240	160	80		
Federal:					
Bureau of Land Mgt.	3,370	3,130	240		
Bureau of Reclamation	490	290	200		
National Forest	300,920	282,620	12,660	4,580	1,060
Total Federal	304,780	286,040	13,100	4,580	1,060
All ownerships	674,680	609,960	43,880	17,210	3,630

Table 3.--Area of commercial forest land by major forest type and stand-size class, 1953

Forest type	Total	Sawtimber stands		Pole-timber stands	Seedling and sapling stands	Non-stocked areas
		Large 1/	Small 2/			
	Acres	Acres	Acres	Acres	Acres	Acres
Ponderosa pine	268,100	174,970	76,140	15,110	1,880	
White pine	8,320	240	2,520	5,330	230	
Lodgepole pine	16,520		10,200	4,860	1,460	
Douglas-fir	226,570	165,540	43,650	10,150	7,230	
Hemlock-Sitka spruce	27,040	16,570	10,350		120	
Larch	29,740	24,540	2,880	2,200	120	
Fir-spruce	94,280	46,880	35,000	6,230	6,170	
Hardwoods	480		480			
Nonstocked	3,630					3,630
Total	674,680	428,740	181,220	43,880	17,210	3,630

1/ 21 inches d.b.h. and larger.

2/ 11 to 21 inches d.b.h.

Table 4.--Area of commercial and noncommercial forest land and nonforest land by cover type and ownership class, 1953

(Acres)

Survey type symbol	Cover type	Total	Unreserved								Reserved		
			Total	Private	State	County	Municipal	Federal: Bureau of Land Mgt.	Federal: Bureau of Reclamation	Federal: National Forest	Total	Municipal	Federal: National Forest
	ALL LANDS												
	Forest land	749,890	728,740	325,260	56,050	520	240	3,570	490	342,610	21,150	80	21,070
	Nonforest land	731,710	692,850 acres of nonforest land unclassified by ownership							23,540	15,320		15,320
	Total	1,481,600								366,150	36,470	80	36,390
	COMMERCIAL FOREST LAND												
P4	Ponderosa pine large sawtimber	176,290	174,970	80,240	24,910		30	1,410		68,380	1,320	80	1,240
P3	Ponderosa pine small sawtimber	76,140	76,140	59,360	11,130	160	130	280	290	4,790			
P2	Ponderosa pine poletimber	15,110	15,110	13,250	1,360		80	40		380			
P1	Ponderosa pine seedlings and saplings	1,880	1,880	1,800						80			
W4	White pine large sawtimber	240	240							240			
W3	White pine small sawtimber	3,100	2,520	1,340						1,180	580		580
W2	White pine poletimber	5,330	5,330	2,360	420				150	2,400			
W1	White pine seedlings and saplings	230	230	150						80			
LP3	Lodgepole pine small sawtimber	10,200	10,200	1,330	160					8,710			
LP2	Lodgepole pine poletimber	4,940	4,860	1,160	920	40				2,740	80		80
LP1	Lodgepole pine seedlings and saplings	1,460	1,460	380	960					120			
D4	Douglas-fir small old-growth and large young-growth sawtimber (red fir)	165,380	165,380	63,190	2,990			850		98,350			
D3	Douglas-fir small sawtimber	43,650	43,650	21,030	1,040			590		20,990			
D2	Douglas-fir poletimber	10,150	10,150	6,550	360				50	3,190			
D1	Douglas-fir seedlings and saplings	7,230	7,230	5,570	760					900			
WL4	Western larch large sawtimber	24,540	24,540	4,750	8,370	220				11,200			
WL3	Western larch small sawtimber	2,880	2,880	630	270					1,980			
WL2	Western larch poletimber	2,200	2,200	880	390	100		200		630			
WL1	Western larch seedlings and saplings	120	120	120									
WF4	White fir large sawtimber	720	720							720			
WF3	White fir small sawtimber	200	200	40						160			
H4	Western hemlock large sawtimber	16,570	16,570	9,480	320					6,770			
H3	Western hemlock small sawtimber	10,350	10,350	6,260						4,090			
H1	Western hemlock seedlings and saplings	120	120	40						80			
FM4	True fir-mountain hemlock large sawtimber	47,910	45,590	15,020	320					30,250	2,320		2,320
FM3	True fir-mountain hemlock small sawtimber	36,910	34,400	10,120	360					23,920	2,510		2,510
FM2	True fir-mountain hemlock poletimber	6,230	6,230	2,910						3,320			
FM1	True fir-mountain hemlock seedlings and saplings	6,370	6,170	2,850						3,320	200		200
S4	Engelmann spruce large sawtimber	570	570							570			
S3	Engelmann spruce small sawtimber	400	400	200						200			
C4	Western redcedar large sawtimber	160	160	40						120			
HD3	Hardwood small sawtimber	480	480	480									
X	Recent logged area nonstocked	1,300	1,300	520	160					620			
XO	Old logged area nonstocked	1,000	1,000	960	40								
F	Deforested by fire, nonstocked	1,330	1,330	890						440			
	Total	681,690	674,680	313,900	55,240	520	240	3,370	490	300,920	7,010	80	6,930
	NONCOMMERCIAL FOREST LAND												
SA	Subalpine	19,580	12,140	1,870						10,270	7,440		7,440
NR	Noncommercial rocky	48,620	41,920	9,490	810			200		31,420	6,700		6,700
	Total	68,200	54,060	11,360	810			200		41,690	14,140		14,140
	NONFOREST LAND												
A&G	Agriculture, grass, and brush	731,710	692,850 acres of nonforest land unclassified as to ownership							4,210	160		160
O	Open--nonvegetative									19,330	15,160		15,160
	Total	731,710	692,850							23,540	15,320		15,320

Table 5.--Area of commercial forest land by generalized forest type and ownership class, 1953

(Acres)

Generalized forest type	Total	Unreserved								Reserved		
		Total	Private	State	County	Municipal	Federal: Bureau of Land Mgt.	Federal: Bureau of Reclamation	Federal: National Forest	Total	Municipal	Federal: National Forest
Conifer large sawtimber 1/ Types P4, W4, D4, H4, C4, WL4, WF4, S4, FM4. Uncut	330,500	326,860	108,460	23,090	220		1,070		194,020	3,640	80	3,560
Selectively cut	101,880	101,880	64,260	13,820		30	1,190		22,580			
Total	432,380	428,740	172,720	36,910	220	30	2,260		216,600	3,640	80	3,560
Conifer small sawtimber 2/ Types P3, W3, LP3, D3, H3, WL3, WF3, S3, and FM3. Uncut	95,750	92,660	32,440	1,800			400		58,020	3,090		3,090
Selectively cut	88,080	88,080	67,870	11,160	160	130	470	290	8,000			
Total	183,830	180,740	100,310	12,960	160	130	870	290	66,020	3,090		3,090
Conifer poletimber Types P2, W2, LP2, D2, WL2, FM2. On cutovers	21,380	21,380	18,180	1,920		80	40	200	960			
On other	22,580	22,500	8,930	1,530	140		200		11,700	80		80
Total	43,960	43,880	27,110	3,450	140	80	240	200	12,660	80		80
Conifer seedlings and saplings Types P1, W1, LP1, D1, WL1, H1, FM1. On cutovers	7,450	7,450	6,290	720					440			
On plantations	80	80	80									
On other	9,880	9,680	4,540	1,000					4,140	200		200
Total	17,410	17,210	10,910	1,720					4,580	200		200
Recent logged area nonstocked Type X	1,300	1,300	520	160					620			
Old logged and burned-over areas, nonstocked Types XO and F	2,330	2,330	1,850	40					440			
Hardwoods Type HD3	480	480	480									
Total	681,690	674,680	313,900	55,240	520	240	3,370	490	300,920	7,010	80	6,930

1/ 21 inches d.b.h. and larger.
2/ 11 to 21 inches d.b.h.

Table 6.--Net volume of live sawtimber[1/] and growing stock[2/] on commercial forest land by ownership class, 1953

Ownership class	Sawtimber		Growing stock
	Million board feet, log scale Scribner rule	Million board feet, International ¼-inch rule	Million cubic feet
Private	4,308	4,691	1,008
State	767	835	179
County	7	7	1
Municipal	1	1	*
Federal			
Bureau of Land Mgt.	46	50	11
Bureau of Reclamation	2	2	1
National Forest	6,395	6,949	1,429
Total Federal	6,443	7,001	1,441
All ownerships	11,526	12,535	2,629

1/ Includes live trees 11.0 inches diameter breast height and larger measured in board feet.

2/ Includes live trees 5.0 inches diameter breast height and larger measured in cubic feet.

* Less than 500 thousand.

Table 7.--Net volume of live sawtimber and growing stock on commercial forest land by stand-size class, 1953

Stand-size class	Sawtimber		Growing stock
	Million board feet, log scale Scribner rule	Million board feet, International ¼-inch rule	Million cubic feet
Sawtimber stands:			
Uncut	10,318	11,207	2,276
Selectively cut	1,136	1,248	306
Total sawtimber	11,454	12,455	2,582
Poletimber stands	62	69	38
Seedling and sapling stands	7	8	8
Nonstocked areas	3	3	1
Total	11,526	12,535	2,629

Table 8.--Net volume of live sawtimber and growing stock on commercial forest land, by species, 1953

Species	Sawtimber		Growing stock
	Million board feet, log scale Scribner rule	Million board feet, International ¼-inch rule	Million cubic feet
Softwoods:			
Ponderosa pine	825	901	181
Western white pine	394	425	93
Lodgepole pine	279	327	98
Douglas-fir	5,067	5,528	1,069
White fir	883	954	242
Noble fir	66	71	15
Pacific silver fir	1,341	1,448	308
Subalpine fir	315	340	127
Western hemlock	1,502	1,622	301
Mountain hemlock	84	91	20
Western redcedar	51	54	14
Western larch	479	518	110
Engelmann spruce	219	232	46
Total	11,505	12,511	2,624
Hardwoods:			
Black cottonwood	21	24	5
Bigleaf maple			*
Total	21	24	5
All species	11,526	12,535	2,629

* Less than 500 thousand.

Table 9.--Net volume of live sawtimber on commercial forest land by diameter-class group, species group, and log rule, 1953

Diameter class and log rule	Total	Ponderosa pine	Western white pine	Douglas-fir	Western hemlock	True firs	Other species
	- - - Million board feet - - -						
11.0" to 20.9" d.b.h.							
Scribner rule	4,289	215	176	1,282	659	1,382	575
International ¼-inch rule	4,773	250	190	1,487	712	1,492	642
21.0" to 30.9" d.b.h.							
Scribner rule	4,604	336	180	2,050	707	890	441
International ¼-inch rule	4,971	362	194	2,214	763	961	477
31.0" to 40.9" d.b.h.							
Scribner rule	1,901	175	38	1,158	136	306	88
International ¼-inch rule	2,027	186	41	1,227	147	331	95
41.0" d.b.h. and larger							
Scribner rule	732	99		577		27	29
International ¼-inch rule	764	103		600		29	32
All diameter classes							
Scribner rule	11,526	825	394	5,067	1,502	2,605	1,133
International ¼-inch rule	12,535	901	425	5,528	1,622	2,813	1,246

Table 10.—Net volume of all timber on commercial forest land by class of material and species group, 1953

Class of material	Total	Softwoods	Hardwoods
	Million cubic feet	Million cubic feet	Million cubic feet
Growing stock:			
Sawtimber trees:			
Sawlog portion	2,131	2,127	4
Upper stem portion	160	160	*
Total	2,291	2,287	4
Poletimber trees	338	337	1
Total growing stock	2,629	2,624	5
Other material:			
Sound cull trees	6	6	*
Rotten cull trees	9	9	*
Salvable dead trees	54	54	*
Total other material	69	69	*
Total, all timber	2,698	2,693	5

* Less than 500 thousand.

Table 11.--Average annual timber cut from live sawtimber and growing stock on commercial forest land by species group for the period 1948-1952 incl.

Species group	Live sawtimber						Growing stock		
	Timber products	Logging residues	Timber cut 1/	Timber products	Logging residues	Timber cut 1/	Timber products	Logging residues	Timber cut 1/
	Thousand board feet, log scale, Scribner rule			Thousand board feet, International ¼-inch rule			Thousand cubic feet		
Softwoods	64,584	3,571	68,155	70,235	3,884	74,119	11,938	1,435	13,373
Hardwoods 2/									
Total	64,584	3,571	68,155	70,235	3,884	74,119	11,938	1,435	13,373

1/ Total of timber products and logging residues. Timber products is the portion of the inventory volume removed from the forest; logging residues is the portion cut or killed in logging and not removed from the forest.

2/ Hardwood cut insignificant.

FOREST SURVEY PROCEDURE

The procedures used in the reinventory of Kittitas County were materially different from the procedures used in the initial inventory. This change in procedures accounts for some significant differences in both the forest-area and timber-volume statistics obtained. Therefore, a brief description of the procedures used in each inventory seems desirable.

Initial Inventory

The initial inventory of the county was conducted in 1935 by what was known as the "compilation method." In this method existing information on forest types, timber cruises, logging records, and other pertinent data, were collected from private timber owners and various public agencies. These data were checked in the field for reliability, and were adjusted to the then existing specifications and standards of Forest Survey. Forest-type and timber-volume data for areas not covered by reliable existing information were obtained through field reconnaissance.

All land in the county was classified as either forest or nonforest. Forest land was further classified as commercial or noncommercial; the commercial was still further classified by forest type, stand-size or condition class, and in case of young growth, by stocking class. All such types and classes were mapped in place on 1-inch-to-the-mile base maps of each forested township. These township type maps were then superimposed over current ownership-status plats and dot counted to obtain forest-type area statistics by ownership class. Type delineations on the township maps were traced to a base map of the county to form a county forest type map. The commercial forest land was also classified as to site quality, or forest-productive capacity.

In-place, timber-volume estimates were based on existing cruises collected and adjusted to the Forest Survey standard, on field samples, and on ocular estimates. Old county cruises were available for nearly all of the privately owned sawtimber. These were checked in the field and found to be very conservative in the case of nearly all species. On the basis of check cruises these county cruises were materially adjusted upward to bring them to the standards set by Forest Survey. Forest Service cruises were available for most of the ponderosa pine sawtimber and for some of the mixed stands of Douglas-fir, western hemlock and the true firs. Through field reconnaissance, average volumes per acre were ocularly made of uncruised sawtimber stands; most of these were mixtures of several species occupying the upper slopes and ridges of the Cascade Range and lateral mountain spurs. These average volumes were applied to the acreages of the uncruised stands. Separate volume estimates were computed for each of the commercial tree species and for each ownership class. Methods used in

this initial inventory do not permit a determination of accuracy of estimate.

Reinventory

In the reinventory in 1953 the forest type map was completely revised. This revision was accomplished through interpretation, classification, and field mapping on aerial photos which covered all but a small part of the commercial forest area. In the delineation of types and conditions on aerial photos in the field, those whose classifications were difficult were examined most closely. The small areas not covered by photos were mapped through ground reconnaissance. Types, stand-size classes, and stocking classes were similar to those recognized in the initial inventory. However, field mapping on aerial photos resulted in much greater accuracy and detail than was possible in the initial inventory through ground reconnaissance alone. Type delineations on the aerial photos were transferred to a 2-inch county planimetric base map through use of a photo projector. The new type map was then superimposed over the current ownership-status map and a dot count made of forest type areas by ownership class.

Estimates of net volumes of live sawtimber, growing stock, sound cull, and salvable-dead material were calculated by applying average per-acre volumes to the appropriate forest-type acreages. The per-acre volumes for sawtimber stands and poletimber stands were obtained through a sampling procedure in which the stands were measured on randomly selected plots. Comparable sawtimber and poletimber volumes in seedling and sapling stands and on nonstocked areas were based on empirical estimates. In the random selection of samples each individual sawtimber or poletimber stand in the county had an equal chance of being selected. A sample consisted of a series of three one-fifth-acre circular plots spaced at 6-chain intervals. Intensity of the sampling was designed to produce a total estimate of volume with a specified sampling accuracy.

ACCURACY OF REINVENTORY DATA

Forest Area

In the reinventory of the county, in-place mapping of the forests and their classification by forest type, stand-size class, or condition class, were on the basis of 100-percent coverage. Thus no error due to sampling was involved. Errors due to techniques or judgment in the field and in office computation of data were possible, but difficult to evaluate. Throughout all phases of the work close supervision and frequent checks assured a high level of accuracy and uniformity of standards.

Timber Volume

The probabilities are about 19 out of 20 that the actual board-foot volume of live sawtimber, if measured by a 100-percent tree cruise, would be within plus or minus 18.8 percent of the estimated total of 11,526 million board feet. On this basis the actual volume would be somewhere between 9,359 and 13,693 million board feet. The same probabilities exist for the estimated 2,629 million cubic feet of growing stock with a range of plus or minus 13.6 percent. The volume estimates by species, stand-size class, or other subdivision, have greater sampling errors than the county totals because smaller volumes are involved.

DIFFERENCE IN RESULTS OF INVENTORIES

Some of the differences in forest-type and timber-volume statistics resulting from the 1935 and 1953 inventories are due to actual physical change. Other differences are due to variations in procedures used, in interpretation and classification of forest conditions, and in standards of utilization. Because of these differences direct comparison of the statistics is not possible.

Forest Area

The major forest-area statistics resulting from the two inventories are shown in the following table:

Inventory	Total forest land	Commercial forest land						Noncommercial forest land
			Sawtimber		Pole-timber	Seedlings and saplings	Nonstocked area	
		Total	Uncut	Selectively cut				
	Thousands of acres							
1935	803	720	469	68	97	73	13	83
1953	750	675	420	190	44	17	4	75

The difference in total forest land acreage--53 thousand acres less in 1953 than in 1935--was very largely due to a difference in classification and mapping of the area near the lower limits of commercial tree growth in the eastern portion of the county and of the area along the summit of the Cascade Range and ridge tops of the lateral mountainous spurs. Along the lower limits of tree growth, sparse stands of ponderosa pine were classed in 1935 as pine woodland and included in the forest land acreage; by 1953 much of this timber had either been cut or killed by forest insects and the resulting nonstocked area was classed as nonforest land. On the high and rocky peaks and ridges near timberline, the use of aerial photos in 1953 permitted more specific separation of the nonforest land from the noncommercial forest stands of poorly formed

trees. This detail resulted in additional areas being mapped in the non-forest category and fewer acres in the forest classification.

The 45-thousand-acre reduction in commercial forest land area was due chiefly to the changes in cover and classification, mentioned above, of the areas along the lower limits of commercial tree growth.

The increase in combined area of sawtimber stands--uncut and selectively cut--from 537 thousand acres to 610 thousand acres, may have resulted chiefly from the ingrowth movement of poletimber stands to sawtimber during the 18 years between inventories.

Timber Volume

The respective estimates of sawtimber volume by species group, obtained in the two inventories are listed in the following table:

Inventory	Live sawtimber volume					
	All Species	Ponderosa pine	Douglas-fir	Western hemlock	True firs	Other species
	Million board feet, log scale, Scribner rule					
Initial, 1935	6,365	1,325	2,265	536	1,316	923
Reinventory, 1953	11,526	825	5,067	1,502	2,605	1,527

Differences in the two estimates of sawtimber volume have no doubt resulted from a number of factors.

Perhaps the factor of greatest influence was the variation, between inventories, in procedures used, and in the specifications upon which the two estimates were based. The 1935 estimate was based on existing cruises, adjusted to the then current utilization standards set by Forest Survey, and on field ocular appraisals of the uncruised sawtimber stands. The 1953 estimate was based on a random sample procedure, as described on page 16.

The influence of differences in procedures cannot be evaluated. The 1953 volume estimate has a calculated sampling error (see page 17 under "Accuracy of Reinventory Data, Timber Volume"). However, no statistical calculation of accuracy can be made for the 1935 estimate. Technique errors, likewise not subject to evaluation, may have affected either one or both of the estimates.

Standards of utilization for the important commercial species, ponderosa pine, were practically the same in both inventories. For the other species, such as Douglas-fir, western hemlock, and the true firs, the standards were different; they were intensified in the 1953 inventory in order to account for the more complete industrial utilization of these species in eastern Washington. This intensification was

accomplished through use of volume tables which gave a considerably greater volume for a tree of a given size than did the tables used in 1935; the minimum top diameter of merchantable length of a sawtimber tree was lowered; and the minimum requirement of net sound volume of a sawtimber tree was reduced from 33-1/3 to 25 percent of gross volume. In the earlier survey greater volume deductions usually were made for both hidden defect and for cull based on surface indicators.

An important factor, one that increased the inventory during the 18 years, was forest growth--net growth in sawtimber trees and the ingrowth of poletimber trees into the sawtimber class. The latter type of growth was particularly significant in the case of species other than ponderosa pine.

Another factor, one that would reduce the timber inventory since 1935, was drain due to timber cutting and to the various natural depleting agencies--forest insects, diseases, windthrow and fire. Cutting drain, which was relatively small in comparison with some of the other counties of eastern Washington and eastern Oregon, was chiefly of ponderosa pine during the first half of the 18 years between inventories. Recently the annual volume of pine cut has declined and other species such as Douglas-fir and western hemlock have comprised major portions of the cut.

Because of these factors the two estimates are not on a comparable basis and do not reflect trends in timber volume.

DEFINITION OF TERMS USED

Land Area

Total Land

Includes dry land and unmeandered water surface.

Forest Land

Includes (a) land which is at least 10-percent stocked by trees of any size and capable of producing timber or other wood products, or of exerting an influence on the climate or on the water regime; and (b) land from which the trees described in "(a)" have been removed to less than 10-percent stocking and which has not been developed for other use. Minimum area of forest land recognized in reinventory of the county was 10 acres.

Nonforest Land

Land that does not qualify as forest land. Minimum area recognized in the reinventory of the county was 10 acres.

Forest Land Classes

Commercial Forest Land

Forest land which is producing, or is physically capable of producing usable crops of wood, economically available now or prospectively, and not withdrawn from timber utilization.

Noncommercial Forest Land

Forest land (a) withdrawn from timber utilization through statute, ordinance, or administrative order but which otherwise qualifies as commercial forest land and (b) incapable of yielding usable wood products (usually sawtimber) because of adverse site conditions, or so physically inaccessible as to be unavailable economically in the foreseeable future.

Productive-reserved. Forest land withdrawn from timber utilization through statute, ordinance, or administrative order, but which otherwise qualifies as commercial forest land.

Unproductive. Forest land incapable of yielding usable wood products (usually sawtimber) because of adverse site conditions, or so physically inaccessible as to be unavailable economically in the foreseeable future.

Forest Types

Forest Type

A forest stand characterized by the predominance of certain key species--in terms of cubic volume for sawtimber and poletimber stands, and in number of trees for seedling and sapling stands--or a forest condition such as nonstocked cutover or burned-over land. In classifying forest land by type the minimum area recognized was 40 acres. The major forest types listed in table 3 are of the following composition:

Ponderosa pine. Stands comprised of 20 percent or more of ponderosa pine by cubic volume or number of trees.

White pine. Stands comprised of 20 percent or more of western white pine by cubic volume or number of trees.

Lodgepole pine. Stands comprised of 50 percent or more of lodgepole pine by cubic volume or number of trees.

Douglas-fir. Stands comprised of 50 percent or more of Douglas-fir by cubic volume or number of trees.

Hemlock-Sitka spruce. Stands comprised of 50 percent or more of western hemlock by cubic volume or number of trees.

Larch. Stands comprised of 50 percent or more of western larch by cubic volume or number of trees.

Fir-spruce. Stands comprised of 50 percent or more of one or more of the true firs (Abies spp.), Engelmann spruce, or mountain hemlock by cubic volume or number of trees.

Nonstocked areas. Cutover or burned-over areas on which the restocking, if any, is less than 10 percent density and which does not support a residual stand meeting minimum sawtimber requirement.

Tree Classes

Sawtimber Tree

Softwood or hardwood tree 11.0 inches d.b.h. or larger containing at least one 16-foot log to a variable top diameter inside bark approximating 40 percent of diameter breast height, but never less than 8 inches, and in which 25 percent or more of the gross board-foot volume is free from rot and defect.

Poletimber Tree

Softwood or hardwood tree 5.0 to 10.9 inches d.b.h. in which 25 percent or more of the gross cubic-foot volume is free from rot and defect.

Cull Tree

Live tree of sawtimber or poletimber size that is unmerchantable, now or prospectively, because of defect or rot.

Sound cull tree. Live tree of sawtimber or poletimber size which contains 25 percent or more of sound volume but will not make at least one merchantable log, now or prospectively, because of roughness or poor form.

Rotten cull tree. Live tree of sawtimber or poletimber size in which less than 25 percent of the total volume is sound.

Salvable Dead Tree

Standing dead or down tree which contains 25 percent or more of sound volume and at least one merchantable log.

Stand-Size Classes

Sawtimber Stand

Stand of sawtimber trees having a minimum net volume of 1,500 board feet, log scale, Scribner rule.

Large sawtimber stand. Stand in which the majority of the volume is in trees more than 21.0" d.b.h.

Small sawtimber stand. Stand in which the majority of the volume is in trees from 11.0" to 20.9" d.b.h.

Poletimber Stand

Stand failing to meet sawtimber-stand specifications but of at least 10-percent stocking of trees 5.0 inches d.b.h. and larger, with at least one-half the minimum stocking in poletimber trees (5.0 inches to 10.9 inches d.b.h.).

Seedling and Sapling Stand

Stand not qualifying as either sawtimber or poletimber stand but having at least 10-percent stocking of trees and with at least one-half the minimum stocking in seedlings and saplings (0-inch to 4.9 inches d.b.h.).

Uncut Sawtimber Stand

Stand that is essentially undisturbed by cutting.

Selectively Cut Sawtimber Stand

Stand in which a partial harvest has been made, and in which the residual volume amounts to 1,500 board feet per acre or more.

Timber Volume

Live Sawtimber Volume

Net volume in board feet of live sawtimber trees:

Scribner rule. The common board-foot rule used in determining log-scale volume of sawtimber in this region. This rule underestimates, particularly in case of timber of the smaller diameters, the volume of lumber that could be produced from the timber.

International $\frac{1}{4}$-inch rule. The standard board-foot rule adopted by the Forest Service in the presentation of Forest Survey volume statistics.

Growing Stock

Net volume in cubic feet of live sawtimber trees and live poletimber trees from stump to a minimum 4.0-inch top (of central stem) inside bark.

Sawtimber Volume

Net volume in board feet of live and salvable dead sawtimber trees to a merchantable top.

All-Timber Volume

Net volume in cubic feet of live and salvable dead sawtimber trees and poletimber trees of commercial species, and cull trees of all species from stump to a minimum 4.0-inch top inside bark.

Commercial Tree Species

Tree species that are considered in determining stocking of stands and growing-stock volume. Includes species presently or prospectively usable for commercial timber products.

Commercial tree species in Kittitas County include:

Softwoods:

Ponderosa pine (Pinus ponderosa)
Western white pine (Pinus monticola)
Lodgepole pine (Pinus contorta)
Douglas-fir (Pseudotsuga menziesii)
White fir (Abies concolor and grandis)
Noble fir (Abies procera)
Pacific silver fir (Abies amabilis)
Subalpine fir (Abies lasiocarpa)
Western hemlock (Tsuga heterophylla)
Mountain hemlock (Tsuga mertensiana)
Western redcedar (Thuja plicata)
Western larch (Larix occidentalis)
Engelmann spruce (Pinus engelmannii)

Hardwoods:

Black cottonwood (Populus trichocarpa)
Bigleaf maple (Acer macrophyllum)

Timber Cut

Timber Cut from Live Sawtimber

Board-foot volume of live sawtimber trees removed from commercial forest land during a specified year as timber products and that left as logging residue.

Timber products. Board-foot volume of live sawtimber entering into timber products during a specified year.

Logging residue. Board-foot volume of live sawtimber that is cut or killed in logging during a specified year but is not removed from the forest as timber products.

Timber Cut from Growing Stock

Cubic-foot volume of live sawtimber and poletimber trees removed from commercial forest land during a specified year as timber products and that left as logging residue.

Timber products. Cubic-foot volume of growing stock entering into timber products during a specified year.

Logging residue. Cubic-foot volume of growing stock that is cut or killed in logging during a specified year but is not removed as timber products.

Accuracy of Data

Sampling Error

A measure of the reliability of timber volume estimates based on the variability shown by sample measurements of the volume.

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117